

# Do Higher Taxes Hurt GSP?

----*The relationship between taxations and GSP*

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## Abstract

We present the empirical analysis of the possible impact on the levels in nominal gross state product per capita, by comparing the tax regimes of the 50 States in the United States. We rely principally on five types of taxes: general sales and gross receipts taxes, individual income taxes, corporation net income taxes, severance taxes and documentary and stock transfer taxes as well as unemployment rate, which we think has non-negligible influence on GSP. For convenience, we use pooled cross-section data in our regression analysis to reduce the error and capture the possible relationship within our models. According to the estimates we have for both models, the total tax is positively related to GSP, while basically all five types of specific taxes are negatively related. What's more, the results show that all variables are, maybe not individually, statistically significant.

Keywords: Taxations, Gross State Product, Taxes per capita, GSP per capita

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## 1. Introduction

The effect of taxation is a very significant aspect of economic behavior. Cooley defines taxation as the process or means by which the sovereign, through its law-making body, raises income to defray the necessary expenses of government. If we express in another way, it is a method of apportioning the cost of government among those who in some measures are privileged to enjoy its benefits and must, therefore, bear its burdens. On the other hand, Malcolm explains that taxation is the power vested in the legislature to impose burdens or charges upon persons and property for the purpose of raising revenue for public purposes.

The relationship between taxes and GDP is also addressed importantly in macroeconomics.

According to basic equation of GDP, the explained variable GDP is affected by the summation of consumption, investment, government spending, and net exports;  $Z=C+I+G+NX$ . In this equation, consumption(C) can be defined as disposable income,  $Y_d$  ( $Y_d=Y-Tax$ ) and it results this equation.

$$Z = C(Y-T) + I + G + NX$$

In this context, the tax has negative relationship with GDP according to the economic logic.

In this article, we present the empirical analysis of the possible impact on nominal gross state product per capita, by comparing the tax regimes of the 50 States in the United States. There are totally 25 tax subcategories, but we only rely principally on five of the most important types of tax to raise revenue. In our model, we use general sales and gross receipts taxes, individual income taxes, corporation net income taxes, severance taxes and documentary and stock transfer taxes. All of these taxes can be a factor of market distortion and potential inefficiencies that impact economic welfare. On the other hand, inspired by the Phillips Curve, a historical inverse relationship between the rate of unemployment and the rate of inflation in an economy, we add the rate of unemployment as another explanatory variable into our model.

The remainder of the paper is structured as follows: Section 2 reviews some relevant literatures and Section 3 describes and does some basic tests on the data we collect. In Section 4, we discussed the Regression models and our estimate results.

## 2. Literature Review

In this section, we review empirical literatures of the impact of taxes at the state level. Over the years, many economists showed their interest in this topic. *The effect of State Tax Incentives on Economic Growth and Firm Location Decisions: An Overview of the Literature* by Terry F. Buss (2000) provides a very comprehensive survey of relevant empirical work. In this article, he reviews the tax study literature about the relationship among taxes, related factors, and economic growth as well as the use of tax incentives to influence business locations. Different from the other studies, this article focus on seeing whether public monies could have been better spent or whether tax incentives were economically justified. Buss (2000) argues that most business tax incentives are the outcomes of interstate competitions to attract businesses from other states. On the other side, states view that the benefits of tax incentives outweigh costs in the long-term.

Martin S. Feldstein (2008) was part of the National Tax Journal forum celebrating the 100<sup>th</sup> anniversary of the National Tax Association. Martin's (2008) tax research has focused primarily on the ways that taxes affect household behavior and on the welfare implications of those changes. That will also

be the focus of this paper, *“Effects of Taxes on Economic Behavior”*. Martin believes that the effects of taxes on economic behavior are important for three distinct reasons. Firstly, the behavioral response of taxpayers affects the revenue consequences of changes in taxes and tax rules. Secondly, the effects on economic efficiency or deadweight loss depend on taxpayers’ compensated behavioral responses, i.e. on the behavioral effects excluding pure income effects. And, thirdly, behavior is important for understanding the short-run macroeconomic consequences of tax changes on aggregate demand and employment. Martin’s (2008) primary focus is on taxes on labor income but he attaches some attention on giving to taxes on income from saving. Specific calculations illustrate the importance of behavioral responses for accurate calculation of the revenue effects and deadweight losses of tax changes.

In *“State Growth Rates: Taxes, Spending, and Catching Up”*, the authors mention about that the American states have grown at different rates throughout the twentieth century. Although many explanations have been proposed, the authors focus on two areas: catching up and state fiscal policies. The authors find that catching up provides the most powerful explanation for differing state growth rates. On the other side, the authors also find that as real state incomes converge, states with relatively low real per capita incomes grow more rapidly than states with relatively high per capita incomes. In the years since 1975, however, the evidence indicates that catching up may be slowing down. Regression results nevertheless provide little support for the hypothesis that differences in state taxes now play the more important role.

In economic studies, one of the most useful ways to discuss issues is to study extreme cases. In *“The effect of Income Taxes on Economic Growth”*, Mike Moffatt (2007) used some extreme cases to show us how tax rates relate to economic growth. He firstly supposes that the society we lived does not have taxation, and consider an opposing case, which sets the tax rate to 100% of our income. These awfully extreme cases sufficiently prove that a reasonable taxation is very important in our life, and even helpful to the economic growth. For the second part, Mike (2007) focus on the government spending. The Capitalism Site lists three necessary things a government must provide: an army, a police force and a court system. Without any of the functions of government, it is easy to see that there would be little economic activity.

The results of previous studies are ambiguous. In fact, people just focused on the relationship between the taxes and the growth rate of economies. Therefore, we decide to directly study the relationship between the GSP level and taxation, which has seldom been touched by others. Economic theories generally believe that, the lower the tax rate is, the higher GSP would be, which implies a negative relationship between the taxes and gross product. Therefore, we use this theoretical context in our hypothesis, and expect to get some negative relations in our model. Finally, we got significant results

proved the generally believed economic theory about relationship between taxes and GSP by ourselves.

### **3. Data**

#### **3.1 Dependent Variables**

##### **3.1.1 Total taxes**

Taxes are very important for government to perform their duties and they also have significant impacts on various social aspect. We want to confirm if the total taxes can affect the GSP even though it doesn't have any information which kinds of taxes are levied in various states of America. Above that, we also tried to ascertain how much the taxes can affect the state economy per ratio of each kind of taxation.

Therefore, we collected data from *United States Census Bureau* about state tax system which includes each kind of taxation ratio and the numerical value total taxation in 2002-2012. The numerical data for total taxes represents dollars in thousands. We also collected some data of state population from same resource and gross state product (GSP, which is the level of economic activities in an area) from *Bureau of Economic Analysis in United States*. After collecting all data, we calculated the logarithm of some numerical value for taxes per capita. From now on, let's introduce some specific kinds of taxes briefly.

##### **3.1.2 General sales and gross receipts taxes**

Taxes on goods and services measured on the basis of the volume or value of their transfer, upon gross receipts or gross income therefrom, or as an amount per unit sold (e.g., gallon, package, etc.); and related taxes based upon use, production, importation, or consumption of goods and services. According to the *state government tax collection*, almost every state has made up lots of revenue portion from this type of tax. For instance, general sales and gross receipt taxes occupy one third of United States total revenue in 2005.

Even though it would be different according to the elasticity of supply and demand, these taxes are easily charged with consumers rather than producer. It means that the rich can be given a tax favor since they usually consume relatively smaller amount of money for consuming products in their total income rather than the poor do. As a result, general sales and gross receipt taxes have a lot of possibility of being regression and encouraging economic inequality. However, we think that those may have a positive impact in the aspect of economic development since they don't affect economic incentive for workers rather than income taxes and corporation taxes do. To prove it, we collected the general sales and

gross receipt taxes for each states in the unit of thousand dollars.

### **3.1.3 Individual income taxes**

Individual income taxes are kind of taxes which are charged to property or estates they earned through economic activity. Since they are levied according to existing substantial wealth, these kinds of taxes are recognized as much progressive kinds of tax comparative to general sales taxes.

Meanwhile, income taxes have an income effect that combine to influence the work-leisure trade off. Income effect means that the reduced real income will give workers less incentive to produce and encourage choosing leisure. If income tax is levied, the virtual income the wage earners would bring will decrease and they are prone to enjoying their free time. In this way, income taxes are prone to reduce the economic incentive so that government tends to concern about the trade-off between the motivation of labor and revenue from income tax. In order to verify this trade-off, we used the tax income of each state for 10 years in the unit of thousand dollars.

### **3.1.4 Corporation net income taxes**

Domestic and foreign corporations are subject to the corporate net income tax for the privilege of doing business carrying on activities; having capital or property employed or used in the United States; or owning property in the United States. Different states levied at the different tax rate on federal taxable income, without the federal net operating loss deduction and special deduction, and modified by certain additions and subtractions. It is generally believed that lowering corporation net income taxes has a positive impact on GSP under the influence of economic incentive and we tried to find out the relationship with taxes data of each states dollar in thousands.

### **3.1.5 Severance taxes**

Severance taxes are incurred when non-renewable natural resources are extracted (or severed) within a taxing jurisdiction. Resources that typically incur severance taxes when extracted are oil, natural gas, coal, uranium, and timber. We tried to find the relationship between severance taxes and GSP; therefore, we used the severance taxes data for each state in the unit of thousand dollars.

### **3.1.6 Documentary and stock transfer taxes**

Documentary and stock transfer taxes are taxes on the passing of title to property from one person (or entity) to another. In a narrow legal sense, documentary and stock transfer taxes are essentially a transaction fee imposed on the transfer of title to property. This kind of tax is typically imposed where there is a legal requirement for registration of the transfer, such as transfers of real estate, shares, or bond.

We wondered whether documentary and stock transfer taxes also has a significant impact on GSP like other kinds of taxes, so we gathered this taxes for each states in the unit of thousand dollars.

### 3.2 Data Description

We gather the data for our seven variables, after taking logarithm, we simply look at our data and try to inspect the behavior of each variables:

Variable	Obs	Mean	Std. Dev.	Min	Max
log(GSP)	50	4.60	0.77	4.45	4.81
log(total tax)	50	3.22	0.16	2.73	3.69
log(general sales and gross receipts taxes)	50	2.59	0.88	0	3.23
log(individual taxes)	50	2.61	0.72	1	3.41
log(corporation net income taxes)	50	1.93	0.62	0	2.96
log(severance taxes)	50	0.94	1.19	-2.27	3.60
log(documentary and stock transfer taxes)	50	1.05	0.59	-0.72	2.15
log(unemployment rate)	50	0.78	0.09	0.53	0.95

### 3.3 Gauss Markov Assumptions Test

Now, let us check whether the data befits the Gauss Markov Assumptions.

#### 3.3.1 Gauss Markov Assumptions 1

For the Gauss Markov Assumptions 1, we have it as linear in parameter in both simple regression model and multiple regressions.

In the simple regression model, as we will explain in more detail later in Part 4.1, we set our model like:

$$\log GSP = \beta_0 + \beta_1 \log Total + u$$

which is quite obvious as a typically model that is linear in parameter as  $\beta_i$  is linear for  $i = 0, 1$ .

Similar to what we have in simple regression model, the Assumption 1 still be satisfied for the case of multiple regression model as we just add more variables into our model using the same format:

$$\log GSP = \beta_0 + \beta_1 \log TotalI + \beta_2 \log General + \beta_3 \log Individual + \beta_4 \log Corporation + \beta_5 \log Severancet + \beta_6 \log Document + \beta_7 \log Unemployment + u$$

In which the Assumption 1 holds too, as  $\beta_i$  is linear for  $i = 0, 1, \dots, 7$ .

### 3.3.2 Gauss Markov Assumptions 2

Since there are only 50 states in U.S., we collect the data for all states. As the data of state population, government tax collections summary report and gross state product (GSP) from 2003 to 2012 are found from the United States Census Bureau, which is always thought to be a reliable data source, as there is believed to have no bias, omission or discrimination in the process of data collecting. Besides, we didn't extract any year between 2002 and 2012 so it does not reflect any private ideas of samplers. As a result, it agrees with random sampling, indicating that the Assumption 2, random sampling, should be satisfied.

### 3.3.3 Gauss Markov Assumptions 3

For the simple regression model, Assumption 3 is the requirement of Sample Variation in the explanatory Variable. After looking at the level of total tax revenue for each state, it is quite obvious that dependent variable  $\log TotalI$  varies as the Total tax revenue is different from state to state.

For the multiple regression models, Assumption 3 is the requirement of not perfect collinearity.

	logtotal	loggen~l	logcor~n	logdoc~t	logind~l	logsev~t	logune~t
logtotal	1.0000						
loggeneral	0.1810	1.0000					
logcorpora~n	0.2574	-0.3010	1.0000				
logdocument	0.1087	-0.1022	0.0056	1.0000			
logindivid~l	0.2551	0.0530	0.5757	-0.0743	1.0000		
logseverant	0.1134	-0.2071	-0.1437	0.0043	-0.2908	1.0000	
logunempol~t	0.0576	0.0730	-0.0152	-0.0125	0.0245	-0.2728	1.0000

According to the table, we have checked all possible linear relationship between one explanatory variable and rest six variables. It's not surprised, after taking the logarithm; all explanatory variables are found not to have perfect collinearity with each other. More specifically, the result tells us that most of collinearity

coefficients are less than 0.3, except two of them which lies between 0.3 and 0.6. Generally speaking, the result shows a quite weak collinear relationship between our dependent variables. As a result, the Assumption 3 is satisfied.

### 3.3.4 Gauss Markov Assumptions 4

To check the Assumption 4, zero conditional mean, we need to calculate the conditional expectation of residual. Based on the models, we can analyze the residuals using Stata easily. For simple regression model, we calculate  $E(u|x_1)$  to be 0.000000000506, and for the multiple regression model, we get  $E(u|x_1, x_2, \dots, x_7)$  as 0.000000000154. It's clear from the result that both of them are very close to zero. Therefore, both our models satisfy Assumption 4.

### 3.3.4 Gauss Markov Assumptions 5

We have the Assumption 5 to be the homoscedasticity, which means the residual has the same variance given any value of the explanatory variables. In order to check the homoscedasticity, we use the White's test for both models.

For the simple regression model, we have the test result to be:

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	<b>0.80</b>	<b>2</b>	<b>0.6697</b>
Skewness	<b>0.81</b>	<b>1</b>	<b>0.3671</b>
Kurtosis	<b>0.43</b>	<b>1</b>	<b>0.5121</b>
Total	<b>2.04</b>	<b>4</b>	<b>0.7275</b>

Similarly, for the multiple regression models, we have the test result as:

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	<b>36.93</b>	<b>35</b>	<b>0.3798</b>
Skewness	<b>3.65</b>	<b>7</b>	<b>0.8191</b>
Kurtosis	<b>0.34</b>	<b>1</b>	<b>0.5578</b>
Total	<b>40.92</b>	<b>43</b>	<b>0.5618</b>

So in both cases, the corresponding p-value is pretty high, which means we can't reject the null Hypothesis that the variance of the residuals is homogenous. In short, we can claim that the Assumption 5,



homoscedasticity, is guaranteed for both of our models.

## 4. Results

### 4.1. Simple Regression Analysis

Ordinary least squares were used in this paper to detect the relationship between states-level economics activities and states taxation. More specifically, we focus on the level of GSP per capita for each state and corresponding the level of average total tax revenue.

In simple linear regression models, the only explanatory variable is the logarithm of average total tax revenue per capita for past several years in America. And we have the logarithm of corresponding average GSP per capita as our explained variable. Datas from 2002 to 2012 were used and tested on a cross-sectional pooled basis for the eleven years between 2002 and 2013. As here in simple linear regression model, the total taxes are classified as the only tax type in our category. Based on this assumption, we can generate the general format of the regression equation as following:

$$\log GSP = \beta_0 + \beta_1 \log Total + u$$

Then applying OLS to this equation, we can get the BLUE as Appendix 1. Therefore, the final estimate function will be:

$$\log GSP_i = 3.98 + 0.19 \log Total_i + \hat{u}_i$$

$$n=50, R^2=0.1683$$

Where we have  $\log \widehat{GSP}_i$  denotes the logarithm of corresponding GSP per capita of state  $i$  (where  $i=1$  to 50, represent Alabama to Wyoming, respectively). Similarly,  $\log Total_i$  denotes the corresponding logarithm of average total tax revenue per capita.  $\beta_0$  and  $\beta_1$  are the parameters to be estimated and  $u_i$  is the residual with zero expected value.

Before going into the detailed analysis, we need to notice that the R-squares value in the result is generally low. However, this would be a logical consequence as the complex nature behind economic activities. On the other side, actually all the factors that are related to economics can, more or less, go into explaining it. Taxation, even appearing in the most fundamental model of modern macroeconomics, should not be expected to play a dominant explanatory role in explaining the relative per capita level of gross state product for the 50 individual states.

## 4.2. Multiple Regression Analysis

As the result we have in simple linear regression analysis is lack of significance, one of the complicated way of regression analysis is to study the relationship between the GSP and different type of taxes.

In the multiple linear regression models, while the explained variable are remaining the same, more explanatory variables have been added to attempt to capture the potential relationship within the model. Instead of using the logarithm of average total tax revenue per capita as the indicator of all sorts of taxation activities within the United State, we divide the total tax revenue into five types. There are general sales and gross receipts taxes, individual income taxes, corporation net income taxes, severance taxes and documentary and stock transfer taxes. Besides, we also add the logarithm of unemployment rate to our model. We think that the unemployment rate is likely to play an important role in the composition of GSP as it can influence the number of population in all working sectors. Applying the same methodology as in the simple regression models, together with  $\log Total_i$ , we can get seven independent variables in our new model:  $\log Total_i$ ,  $\log General_i$ ,  $\log Individual_i$ ,  $\log Corporation_i$ ,  $\log Severance_i$ ,  $\log Document_i$ ,  $\log Unemployment_i$ . Then, similar to the simple version, based on this assumption, we can regenerate the general formula by inserting new variables:

$$\log GSP = \beta_0 + \beta_1 \log Total + \beta_2 \log General_i + \beta_3 \log Individual + \beta_4 \log Corporation + \beta_5 \log Severance + \beta_6 \log Document + \beta_7 \log Unemployment + u$$

Similarly, applying OLS to this equation, we can get the BLUE as Appendix 2. Therefore, the final estimate function is like:

$$\widehat{\log GSP}_i = 3.98 + 0.31 \log Total_i - 0.041 \log General_i - 0.02 \log Individual_i - 0.035 \log Corporation_i - 0.02 \log Severance_i + 0.03 \log Document_i - 0.19 \log Unemployment_i + \hat{u}_i$$

$n=50, R^2=0.5311$

Where we have  $\widehat{\log GSP}_i$  denotes the logarithm of corresponding GSP per capita of state  $i$  (where  $i = 1$  to  $50$ , means Alabama to Wyoming, respectively). Similarly, we have  $\log Total_i$ ,  $\log General_i$ ,  $\log Individual_i$ ,  $\log Corporation_i$ ,  $\log Severance_i$ ,  $\log Document_i$  and  $\log Unemployment_i$  denote the corresponding tax variables and the rate of unemployment respectively.  $\beta_0$  to  $\beta_7$  are the parameters to be estimated and  $u_i$  is the residual with zero expected value.

## 4.3. Result Interpret

Based on the regression result in the 4.1 and 4.2, we can put the estimates and their corresponding t-stat in the following table:

Dependent Variable: <b>logGSP</b>		
Independent Variables:	Simple Regression Model	Multiple Regression Model
<b>logTotal</b>	0.1944736 (3.12**)	0.310055 (5.40***)
<b>logGeneral</b>	-	-0.0414224 (-3.77***)
<b>logCorporation</b>	-	-0.03506 (-1.93)
<b>logDocument</b>	-	0.0265837 (1.88)
<b>logIndividual</b>	-	-0.021796 (-1.46)
<b>logSeverant</b>	-	-0.024189 (-3.03**)
<b>logUnemployment</b>	-	-0.1938419 (-2.08*)
<b>No.of obs.</b>	50	50
<b>R-square</b>	0.1683	0.5311

From the table of the simple linear regression model, the estimated coefficient itself is out of our expectation while some measures of fitness such as R-square value are so closed to what has been discussed. In the table, we can find that the exactly estimate of  $\beta_1$  is a 0.19, a small positive coefficient indicating that higher total tax per capita should result in a higher GSP per capita. More specifically, increase one percent in total tax revenue will increase GSP by 0.19 percent. This result is unexpected as we thought there should be a negative relation between the GSP and tax revenue. Actually, we found that many types of taxes are designed to be collected as a fixed proportion of some economic activities. For example, the sales tax rate in Georgia is 8%. Therefore, the stronger consumption activities are, the higher general sales tax revenue will be.

For the multiple regression models, comparing with the estimates obtained under simple regression model in the last part, we can observe the big improvement in both measures of fitness. For example, R-square value increases from 0.1683 to 0.5311, and statically significance of our estimates. In this model, we have six new variables, and for majority of their estimates, we get some quite significant answers, as five out of six are negative. This result indicates that, unlike the increase in total tax revenue which is going to increase GSP, the increase in four type of taxes (general sales tax, individual income tax, corporation income tax, severance tax) and unemployment rate will result in the decrease of GSP, which indeed follows our expectation as higher taxes increase the cost of all sorts of economic activities and transactions such as a lower wage and a higher transaction fee.

#### 4.4. Robustness Tests

For our simple regression model:

$$H_0 : \beta_1 = 0 \quad H_1 : \beta_1 \neq 0$$

we can calculate that the t-value is equal to 3.12. Since the degree of freedom is 49, we obviously know that the critical value at 5% level against a two-sided alternative is 2.01 from the table of Critical Values of the t Distribution. Comparing with the t-value above, the critical value is smaller. On the other side, the p-value is 0.003, which equals to 0.3%. 0.3% is much smaller than 5%, and then we can reject our hypothesis. Therefore, we can say there is a strong relationship between the GSP and the total taxes, which means our simple regression model is significant.

On the multiple regression models, there are six explanatory variables which we used to find the relationship with GSP. Before we test the significance of each variable, let us set up the null hypothesis for each variable.

$$H_0 : \beta_i = 0 \quad H_1 : \beta_i \neq 0 \quad (i = 1 - 7)$$

In this case of *logTotal*, *logGeneral*, *logSeverent*, and *logUnemployment*, the numbers of t-value for each variable are 5.40, -3.77, -3.03, 22.90. Considering that we have 2.02 as the critical value of two-sided 5% with the degree of freedom 42, the absolute values of these four variables are all relatively larger than the numbers of critical value. When it comes to P-value, the P-values of each variable are 0.000, 0.001, 0.004, and 0.000, which equals to 0%, 1%, 4% and 0%. It is evidently lower than 5%, critical number of our test. Besides, the confidence intervals of each variable are (0.194, 0.425), (-0.063, -0.019), (-0.0402, -0.008), and (-0.3817, -0.0059), which do not include “zero”. In this context, we confirm these four variables are statistically significant.

On the other hand, if we repeat the calculation above, we can get that the numbers of t-value for *logcorporation*, *logdocument*, and *logindividual* are -1.93, 1.88, -1.46. The absolute values of these t-values are smaller than 1.96, the critical value of 5% t-stat. Similarly, the p-values of these three variables are 6.1%, 6.7%, and 15.3% which are obviously larger than 5%. Lastly, the confidence intervals of these *logcorporation*, *logdocument*, and *logindividual* are (-0.0717, 0.0016), (-0.002, 0.0551), and (-0.052, 0.0084) that all include “zero” value. As a result, we conclude that null hypothesis cannot be rejected and the three variables are not statistically significant.

After calculating the values for individual significance, we make an attempt to find the joint significance between six variables except *logUnemployment*. We exclude *logUnemployment* since our major attention is on the relationship between different kinds of taxes and GSP. For this reason, we make

this null hypothesis as following:

$$H_0 : \beta_1 = 0, \beta_2 = 0, \beta_3 = 0, \beta_4 = 0, \beta_5 = 0, \beta_6 = 0$$

$$H_1 : H_0 \text{ not true}$$

Even though some of variables between  $\beta_1 \sim \beta_6$  are individually significant, we cannot be sure about the joint significance of these variables because the individual and joint significance are independent. Therefore, with the formula for reckoning F-stat, we judged the joint significance of six taxes variables. As using the data above, R-square of unrestricted model is 0.5311, and  $n-k-1$  is 42. Likewise, we could find out that R-square of restricted model is 0.0168 as following the data below and we already recognized that the restricted variables number ( $q$ ) is six. With this number, we have the F-stat of this hypothesis.

Source	SS	df	MS			
Model	.00488406	1	.00488406	Number of obs =	50	
Residual	.286534527	48	.005969469	F( 1, 48) =	0.82	
Total	.291418588	49	.005947318	Prob > F =	0.3702	
				R-squared =	0.0168	
				Adj R-squared =	-0.0037	
				Root MSE =	.07726	

  

loggsp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
logunempoly~t	-.1085778	.1200379	-0.90	0.370	-.3499301	.1327746
_cons	4.687644	.0947457	49.48	0.000	4.497145	4.878143

$$F = \frac{(R^2_{UR} - R^2_R) / q}{(1 - R^2_{UR}) / (n - k - 1)} = \frac{(0.5311 - 0.0168) / 6}{(1 - 0.5311) / 50 - 7 - 1} = 7.67$$

Considering 5% critical value of  $F_{(6,42)}$  is close to 2.33, the value of F-stat is very high. Since it goes beyond the 5% critical value in a huge amount, we can reject  $H_0$  and have a conclusion that the six variables are jointly significant. Even with 1% critical value of  $F_{(6,42)}$  which indicates almost 3.4, we could reject  $H_0$  because 7.67 is much bigger than 3.4 overwhelmingly. As a result, we conclude that these six taxes variables are jointly significant with evident statistical proof.

## 5. Conclusion

Do taxes have any impressive impact on the per capita gross state product? Based on our study in this paper, the answer is "Maybe!". In our simple regression model, the coefficient of the total taxes is greater than zero, which means that the correlation between the GSP and the total taxes is positive. In

other words, the higher the total taxes are, the higher the GSP is. On the other side, in the multiple regression model, we can conclude our results as following: the coefficients of general sales, taxes, individual income taxes, corporation net income taxes and severance taxes, are smaller than zero. This implies that these four variables, as we expect, are negatively related to GSP. Therefore, we can see that, the higher GSP of the state is, the lower general sales and gross receipts taxes, individual income taxes, corporation net income taxes and severance taxes are. Besides, for the simple regression model, the our R-square value is 0.17, it is acceptable as the limited number of variables. However, for the multiple regression model, the R-square value increases to 0.53, a considerable level. In addition, based on the significance tests, we have that, for simple regression model, our estimate is quite significant, while this conclusion can still apply to many estimates in multiple regression model. After checking the jointly significance, eventually, we can draw our conclusion as the estimates we obtained are statistically significant. In all, although the conclusion we have is ambiguous, some our of result still show the significant negative relation we expect.

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